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AN ENTOMOPHTHORA ATTACKING CITRUS RED MITE

FRAN. E. FISHER[1]

Florida Citrus Experiment Station, Lake Alfred

One of the most serious pests of Citrus in Florida is the citrus red mite, *Paratetranychus citri* (McG.), which is commonly known in this state as the purple mite. Although this mite has been known in Florida since before 1885 [Riddle (5)], only during the past two decades has it assumed major importance in all of the citrus areas in this state. Because red mites have a short life cycle and are small in size, heavy infestations can build up quickly and rather inconspicuously. Mites may be found at almost any season of the year, but the damage they cause is negligible until they become abundant. These pests attack the leaves, young twigs, and fruit causing an injury which is grayish in color. This damage is difficult to measure or estimate unless there is a leaf drop. During the fall, winter, and spring months, the injury caused by heavy infestations has, at times, resulted in a heavy leaf drop in many groves.

In 1944 Thompson (14) pointed out that sulfur sprays had been effective in upsetting the natural balance of control of red mites, and that reinfestations of these mites were frequently more severe following a sulfur spray than in adjacent non-sprayed control plots. Previously, Thompson (13) had reported that red mites became more abundant following copper sprays than where no copper had been applied. In 1948 Thompson and Stearns (15), in a comparison of two post-bloom sprays, showed that the amount of copper deposited from a copper-wettable sulfur spray was, on the average, 1.8 mcg/cm^2 whereas a copper-oil spray resulted in an average deposit of 3.4 mcg/cm.^{2} Six months after these sprays the red mite infestations were 8 percent and 59 percent respectively. He suggested (14) the possibility that fungicidal sprays retarded the effectiveness of any entomogenous fungi that might be present.

Although a survey of the available literature has failed to show that a specific fungus has been found to be associated with red mites, the mites have been reported to disappear during the summer and early fall months (6, 14). These epizootics have in the main been attributed to high temperatures (6, 14) or to

[1] The writer is indebted to Dr. R. M. Pratt for valuable suggestions and to J. K. Enzor, Jr., I. H. Holtsberg, K. G. Townsend, and J. B. Weeks for collecting material and aiding in making counts in the field.

unknown causes (4). Griffiths and Thompson (3) reported four insect predators, a trash bug, an aphis-lion, and two ladybeetles, as being predaceous on red mites in Florida. They concluded that counts made on these predators could not be satisfactorily correlated with increases and decreases of infestations, and that there was apparently some other factor which played an important role in the natural control of red mite infestations.

In 1948, the writer observed fungus hyphal bodies and resting spores in red mites. However, the material was not sufficient to determine the identity of the fungus. In August of 1950 this fungus was observed again in our laboratory by Miss Jean Linebaugh. Since that time specimens have been numerous and all stages of parasitism have been found. This endoparasitic fungus attacking red mites has been identified as *Entomophthora* sp.

The genus *Entomophthora* belongs to the order Entomophthorales and to the class Phycomyceteae. According to Bessey (1), "some species of this genus are called *Empusa* by some writers, but since this name was used earlier for a genus of Orchids the next later name, *Entomophthora,* must be used." The members of this genus are all parasitic within insects (1) and were long thought to be obligate parasites. However, several species have been grown in culture (7, 8, 9 and 10). Probably other species will be induced to grow in culture when the proper media and conditions are provided.

A number of species of *Entomophthora* are economically important. Among these are E. *muscae* on the common housefly, *Musca domestica* Linn.; E. *grylli* on grasshoppers; and E. *fumosa* attacking the citrus mealybug, *Pseudococcus citri* Risso. Speare (11) has reported that in Florida E. *fumosa* was unquestionably the major factor in the natural control of the citrus mealybug. The species of *Entomophthora* attacking red mites is similar to E. *fumosa,* but does not appear to be the same species.

In general, species of *Entomophthora* infect insects by the penetration of the integument and the appendages (12). After the conidium germinates and the germ tube penetrates into the body cavity, the hypha forms thick segments which break apart from one another. These are the hyphal bodies which multiply and which dissolve the internal organs of the host, presumably by enzymes which the fungus secretes (1). After the insect is dead and the food supply depleted, the hyphal bodies may develop in one of two ways. Under unfavorable environmental

conditions, the hyphal bodies may develop thick walls and form resting spores (2). Under favorable conditions the hyphal bodies form conidiophores which emerge through the integument of the insect and produce conidia. As the conidium matures, the conidiophore and the conidium absorb water. Finally a strong pressure is developed which causes the conidium to be violently discharged into the air. If the conidium fails to strike an insect it may germinate forming a secondary conidium which is, in turn, discharged. This process may take place until a host is located or the protoplasm in the conidium is exhausted. In some species true zygospores may be formed, but in others the resting spores are asexually developed.

Red mites infected with *Entomophthora* may show one of several external manifestations. The first indication of disease can be determined in living mites by observing the movement of the adult mite. In all cases, to date, mites which move slowly in a staggering or weaving manner have been found to be infected with hyphal bodies. These mites may contain from 2 or 3 long-ovoid hyphal bodies to a larger number which fill approximately one-half of the body cavity. Mites which have recently died appear normal at first glance, but do not move when touched with a needle. These mites have been found to be completely, or almost completely, filled with hyphal bodies. No remaining part of the internal organs can be distinguished, but the red pigment is still present and is distributed throughout the body between the hyphal bodies.

Mites killed by the fungus generally exhibit one of two appearances. If favorable development of the fungus has taken place, the body of the mite will be somewhat distended, cheesy in consistency, and dark red or dark purple in color, occasionally with a grayish tinge. These mites usually show some stage of conidiophore development. The grayish tinge if present, is indicative that the fungus is mature and that conidia have been produced by the conidiophores. Under unfavorable conditions, mites contain resting spores, are usually very hard when cut with a needle, and are dark purple to black in color. These mites are generally a little smaller than normal or hyphal-body-filled mites; rarely are they distended.

Figure 1 shows a side view of an adult, dead, red mite which was killed by *Entomophthora* sp. It should be noted that the conidia which are just outside of the integument are formed

on the dorsal side of the mite. To date the formation of directly-ventral conidiophores and conidia has not been found.

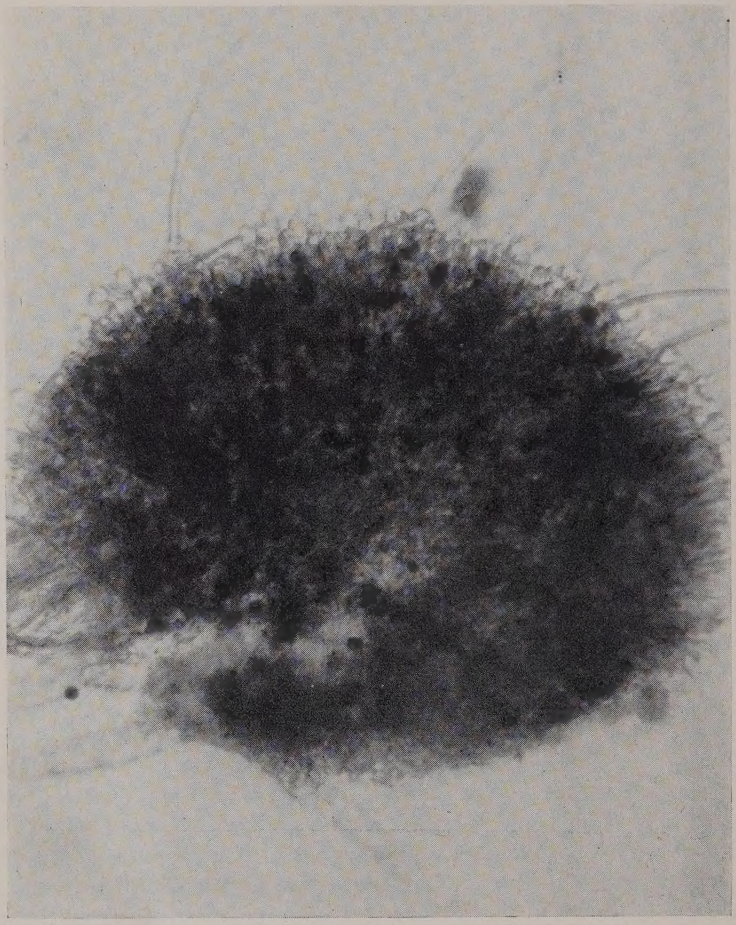

Fig. 1. Photomicrograph of citrus red mite killed by *Entomophthora* sp.

Although this disease is more prevalent and the fungus development is more typical in adult mites than in younger stages, it has been found to attack deutonymphs. No visible infection has been found in protonymphs.

This species of *Entomophthora* has been found throughout peninsular Florida, south of Mount Dora to Avon Park and from

east of Tampa to Fort Pierce. All examinations of heavy mite infestations in groves between these points have shown the disease to be present. Because of this occurrence in groves scattered over such a wide area, it is probable that the fungus is present throughout the citrus belt.

During September and October, counts made in groves with heavy infestations showed adult mortalities ranging from 32 to 95 percent. In October four counts were made in a Temple grove near Tampa in order to learn more about the mortality of the population as the various generations matured. Table 1 shows the percent infestation in this grove, the percent adults, and the percent mortality of adult mites due to *Entomophthora* sp. It is interesting to note that during the period of highest mortality, the percent of leaves infested was the lowest. No predators were found during this period of observation.

TABLE 1.—MORTALITY OF A RED MITE POPULATION DUE TO *Entomophthora* sp.

Date	Percent Leaves Infested	Percent Adult Mites	Percent Adult Mortality
October 11	96	13.23	37.60
October 20	84	23.28	70.54
October 27	93	14.29	32.19
October 31	90	27.89	58.62
Average	90.7	19.67	49.74

Additional study of this disease will be necessary in order to determine its importance in the biological control of red mites. The climate, *Entomophthora,* and the various predators undoubtedly have interacting effects on the red mite infestations.

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CHECK LIST OF THE SYRPHID FLIES (DIPTERA: SYRPHIDAE) OF FLORIDA

HOWARD V. WEEMS, JR.
Department of Zoology and Entomology, Ohio State University

The family Syrphidae comprises one of the few large families of flies which, viewed from an economic standpoint, are of great benefit to man. The larvae of a considerable number of species are aphidophagous, destroying countless numbers of plant lice and other injurious insects which suck the juices of plants. In many areas syrphid larvae are a principal natural control of aphids on truck crops and citrus. The adults commonly visit flowers for nectar and serve an important role in effecting cross-pollenation of plants. Only a few species accidentally introduced into the United States from Europe are known to be harmful, feeding on bulbs of narcissus, amaryllis and onion, and none of these is known to occur in Florida. There are a few authenticated records of accidental parasitism in man, but these are of little significance. Certain species of syrphids have been used by scientists in the laboratory in the study of the physiology of insects, in genetics, and in cytology. Many are of value as scavengers, consuming decaying animal and vegetable matter which otherwise would be a nuisance to man.

Adult flies present a remarkable diversity of size, form, and coloration, some resembling bees, wasps, and bumblebees so closely that they are frequently mistaken for the latter. Many species are brightly striped, banded, or otherwise colored with yellow, orange, green and blue, and range from relatively smooth, shiny species to several which are densely hairy. In some cases even the eyes are densely pubescent.

The only check list of the Syrphidae of Florida was published in 1913 by C. W. Johnson and included 21 genera and 56 species, several of which were incorrectly determined. There has been relatively little work done in Florida on this interesting family of flies since that of Johnson. I began a study of the Syrphidae in 1945, and have collected a sufficient number of species to warrant publishing this list which includes 103 species, in 32 genera. Records are included from the U. S. National Museum, American Museum of Natural History, Academy of Natural Sciences of Philadelphia, Ohio State University Museum, Ohio State Archaeological and Historical Society Museum, Illinois

Natural History Survey collection, Emory University Museum, and from a survey of published records in the literature. Further collecting, undoubtedly, will add a fair number of species to this list. Apparently, there has been no collecting done in northwestern Florida, and only casual collecting in other parts of the state. Present records indicate that other species recorded from Cuba and the West Indies will be found on the southern-most part of the mainland and on the Florida keys. To attempt at this time to map the distribution of each species would be premature, since careful collecting has been done in only a few localities.

This list compares favorably with those for other states. Hull (1947) lists 105 species in 45 genera for Mississippi. Brimley (1938, 1942) records 128 species in 42 genera for North Carolina, which has been intensively collected by Metcalf, Shannon, and others. Smith (1909) lists 132 species in 45 genera for New Jersey. Britton (1920) lists 112 species in 41 genera for Connecticut. Metcalf in a 1913 list, to which many species have been added in recent years, shows 114 species in 35 genera for Ohio. Telford (1939) lists 135 species in 52 genera for Minnesota.

I have collected Syrphids principally in north-central Florida around Gainesville, in south-central Florida around Sebring, Highlands Hammock State Park, Lake Placid, and Clewiston, and southward from Miami to Key West. Plans for the future include concentrated collecting west of Tallahassee. At some future time I plan to publish a key to the Syrphidae of Florida as well as descriptions of several new species which I have collected in Florida. It is hoped that this list will stimulate interest in the family which will result in the discovery of new state records.

Locality records for each species are listed in order beginning with northwest Florida and proceeding eastward to Tallahassee and Jacksonville, then southward. Specimen records for each locality are listed in sequence, beginning with the earliest date and proceeding to the most recent. For each specimen, all available information is given in the following order: locality, date, collector, host plant, determiner, number of specimens having duplicate data, source of record (if taken from the literature), and location of the specimen(s). In each record where the number of specimens is not given, only one is indicated.

All specimens listed were seen by me with the exception of some specimens recorded by Johnson and Williston which are not located now in the American Museum of Natural History, United States National Museum, or Academy of Natural Sciences of Philadelphia. Florida specimens in my collection total 516; a total of 1453 specimens taken in Florida was examined in compiling this check list.

Unless otherwise indicated, I am responsible for the identification of any material in my collection; Dr. C. H. Curran is responsible for determination of material in the American Museum of Natural History; Dr. R. C. Shannon, Dr. J. R. Malloch, Mr. C. T. Greene, and several others are responsible for determination of material in the United States National Museum; Dr. R. C. Osburn is responsible for determination of material in the Ohio State University collections; Dr. C. L. Metcalf is responsible for determination of material in the Illinois Natural History Survey collection; and Dr. E. T. Cresson and others are responsible for determination of material in the Academy of Natural Sciences of Philadelphia. In taking the data from specimens in these collections, I have checked determinations, and the few corrections which were made have been indicated in this paper. Responsibility for determination of species records taken from the literature lies with the authors of such publications. Many of my specimens were sent to Curran, Fluke, and Hull for determination or check on my determinations, especially where a probable new species was involved. Where records are from the literature, location of specimens is not known unless it is so indicated. I have followed Hull's (1949) arrangement of genera and subgenera. Mr. Erdman West, botanist and mycologist at the University of Florida, determined plant hosts of numerous specimens which I took.

LIST OF ABBREVIATIONS

Collectors:†

CAM = C. A. Mosier
CHTT = Dr. C. H. T. Townsend *
CLM = Dr. C. L. Metcalf *
CR = Dr. Charles Robertson *
CWJ = Dr. C. W. Johnson *
HVW, Jr. = H. V. Weems, Jr.
Mrs. ATS = Mrs. A. T. Slosson *
Mrs. CHTT = Mrs. C. H. T. Townsend

PWF = P. W. Fattig
RCO = Dr. R. C. Osburn
RST = R. S. Turner
WPH = W. P. Hunter

Determiners:

(CHC) — Dr. C. H. Curran, Curator of Natural History, The American Museum of Natural History, New York, N. Y.
(CLF) = Dr. C. L. Fluke, Department of Economic Entomology, University of Wisconsin, Madison, Wisc.
(CLM) = Dr. C. L. Metcalf *
(CTG) = Mr. C. T. Greene, retired, USDA, 4805 Guilford Road, College Park, Md.
(CWJ) = Dr. C. W. Johnson *
(FMH) = Dr. F. M. Hull, Chairman, Department of Biology, University of Mississippi, Oxford, Miss.
(HST) = Dr. H. S. Telford, Wash. Exper. Station, Div. of Entomology, Wash. State College, Pullman, Wash.
(HVW, Jr.) = H. V. Weems
(JSH) = J. S. Hine *
(RCO) = Dr. R. C. Osburn, 1861 Mission Street, So. Pasadena, Calif.

Collections:

(AMNH) = American Museum of Natural History, New York, N. Y.
(ANSP) = Academy of Natural Sciences of Philadelphia, Philadelphia, Pa.
(CLF coll.) = C. L. Fluke collection, University of Wisconsin, Madison, Wisc.
(CLM coll.) = C. L. Metcalf collection, Illinois Natural History Survey collection, University of Illinois, Urbana, Ill.
(EUM) = P. W. Fattig collection, Emory University Museum, Emory University, Ga.
(INHS) = Illinois Natural History Survey collection, Urbana, Ill.

† In a few cases where data were taken from labels on museum specimens, only the initials of the collector were given, and efforts to ascertain their meaning were unsuccessful. Therefore, where initials occur which are not given in this list of abbreviations, the meaning of the initials is not known to me.

* Deceased.

(OSM) = Ohio State Archaeological and Historical Society Museum, Ohio State University, Columbus, Ohio
(OSU) = Department of Zoology and Entomology Museum, Ohio State University, Columbus, Ohio
(THH coll.) = T. H. Hubbell collection, University of Michigan, Ann Arbor, Mich.
(USNM) = United States National Museum, Washington 25, D. C.

Miscellaneous Abbreviations:

coll. = collection
det. = determined by
on = feeding at or resting on
spm. = specimen
spms. = specimens
syn. = synonym of

BACCHA Fabricius

Baccha calypsa Hull

ORLANDO 1-5-25 Holotype (AMNH).

Baccha (Dioprosopa) clavata Fabricius

ST. GEORGE 5-7-1880 RST Pupa found in orange—listed by Williston (1886) under syn. *B. babista* Walker. JACKSONVILLE 3-11-? (CHC) 5 spms. (AMNH). ST. AUGUSTINE 2 spms. (ANSP). GAINESVILLE 2-23-19 PWF (CLF) (EUM); 5-18-19 PWF (CLF) (EUM); 5-20-19 PWF (CLF) (EUM); 6-26-35 WPH (FMH); 6-29-35 WPH (FMH) 3 spms.; 7-3-35 WPH (FMH); 10-27-39 (FMH) (THH coll.); 10-18-40 (FMH) (THH coll.); 3-8-44 (FMH) (THH coll.); 11-27-46 (FMH) (THH coll.); 12-3-47 HVW,Jr. on *Bidens bipinnata* (FMH) 2 spms.; 12-8-47 HVW,Jr. on *Bidens bipinnata* (FMH); 12-9-47 HVW,Jr. (FMH) 2 spms.; 2-17-48 HVW,Jr. on *Cercis canadensis* (FMH) 2 spms. CRESCENT CITY 2 spms. (USNM). TITUSVILLE 4-25-23 3 spms. (AMNH). ORLANDO 5-25-07 (Russell coll.) Larvae with *Aphis gossypii* (USNM); 1-12-09 (Russell coll.) (USNM); (Russell coll.) 3 spms. (USNM). LAKE WALES 4-29-24 (USNM). SEBRING 6-9-49 HVW,Jr. on *Bidens bipinnata;* 12-24-49 HVW,Jr. on *Bidens bipinnata;* 12-31-49 HVW,Jr. on *Bidens bipinnata.* LAKE PLACID 12-26-50 HVW,Jr. on *Bidens bipinnata.* PORT SEWELL 1-1-39 L.C.& L.J. Sanford (AMNH). VENICE January-February 1934 R.R.Bales (OSM). CHARLOTTE HARBOR Mrs.ATS (AMNH). GROVE CITY 6-7-1890 to 6-27-1890 (USNM). CLEWISTON 12-29-50 HVW,Jr. on *Bidens bipinnata* 4 spms. FORT MYERS 1-10-33 W.M.B. 2 spms. (OSM); 1-10-33 WMB 3 spms. (OSU); 11-16-11 (AMNH). SANIBEL February 1923 Reared on plant lice (JSH) (OSU). MIAMI 1-4-51 HVW,Jr. on *Bidens bipinnata* 4 spms.; November 10 Mrs.CHTT

(USNM); November 28 Mrs.CHTT (USNM). COCONUT GROVE 5-23-1887 E.A.Schwarz (USNM). HOMESTEAD 12-1-17 CHM on wild aster 2 spms. (USNM). FLORIDA CITY 3-21-51 HVW,Jr. on *Galium triflorum* 3 spms.

Baccha costata Say

Baccha tarchetius Walker and *Baccha costata* Say of Williston are synonyms. JACKSONVILLE Mrs.ATS—listed by Johnson (1913) as *B.tarchetius* Walker. GAINESVILLE September 26 - October 2 1914 (AMNH); (RCO coll.) (OSU); 12-9-47 HVW,Jr.on *Citrus* sp. (FMH); 3-16-48 HVW,Jr. on *Pyrus* sp. (FMH). INVERNESS March 26 CR—listed by Johnson (1913) as syn. *B.tarchetius* Wlk. ORLANDO March 16—listed by Johnson (1913) as *B.tarchetius* Wlk. HIGHLANDS HAMMOCK STATE PARK 3-24-51 HVW,Jr. on *Ilex glabra.* SEBRING 6-9-49 HVW,Jr. on *Sambucus simpsonii* (CLF) 2 spms. FLORIDA 2 spms. (USNM). SOUTH FLORIDA March 1923 JSH (OSU).

Baccha cubana Hull

FT. MYERS 1-1-33 W.M.B. (RCO). SOUTH FLORIDA March 1923 JSH (RCO).

Baccha fascipennis Wiedemann

One spm. (USNM) labelled "Florida." Although the general distribution of this species has been considered northern, this record seems to be valid; it is recorded also from Georgia.

Baccha fuscipennis Say

DeFUNIAK SPRINGS 3 spms. (AMNH)—2 spms. erroneously labelled *B.cylindrica* Fabr. which is correctly recorded from West Indies. JACKSONVILLE Mrs.ATS (AMNH); (USNM). ST. AUGUSTINE March 15 CWJ; May 20 CWJ; 4-17-19 CLM (CLM coll.); 4-19-19 CLM (CLM coll.). GAINESVILLE 1914 (AMNH)—erroneously labelled *B.cylindrica* Fabr.; 2-23-19 PWF (CLF) (EUM); 5-23-19 PWF (CLF) (EUM); (RCO coll.) (OSU). PALATKA 2-10-1868 E.B. (USNM). CRESCENT CITY (USNM). SEA BREEZE 2-23-16 (ANSP). TITUSVILLE 4-25-23 (AMNH). HIGHLANDS HAMMOCK STATE PARK 6-7-49 HVW,Jr.; 7-28-49 HVW,Jr. 2 spms.; 3-27-50 HVW,Jr.; 3-24-51 HVW,Jr. LaBELLE April 27—listed by Johnson (1913) as syn. *Ocyptamus fuscipennis* Say. LAKE WORTH Mrs.ATS—listed by Johnson (1913) as syn. *Ocyptamus fuscipennis* Say. FT. MYERS 1-10-33 W.M.B. 2 spms. (OSM). MIAMI 4-21-23 3 spms. (AMNH). BISCAYNE BAY Mrs.ATS—listed by Johnson (1913) as syn. *Ocyptamus fuscipennis* Say. Two spms. labelled "Florida" (C.V.Riley coll.) (USNM).

Baccha fuscipennis fenestrata (Hull)

ALACHUA COUNTY 10-16-38 (FMH); 12-10-39 (FMH) (M.T.James coll.). GAINESVILLE 19? (FMH); 1-16-47 HVW,Jr. HIGHLANDS HAMMOCK STATE PARK 12-23-50 HVW,Jr. 2 spms.; 3-24-51 HVW,Jr.

Baccha gastrostacta Wiedemann

BISCAYNE BAY Mrs.ATS—listed by Johnson (1913) as syn. *Ocypta-*

Ocyptamus trigonus Wied.; *B.torva* Will. is another syn. which occurs frequently in literature.

Baccha latiuscula Loew

HIGHLANDS HAMMOCK STATE PARK 12-23-50 HVW,Jr. 2 spms. (Curran, 1951, examined ♀ and labelled it "*Baccha* sp.—need ♂"). CHOKOLOSKEE (OSU).

Baccha lugens Loew

JACKSONVILLE Mrs.ATS (Johnson 1913). CRESCENT CITY Hubbard (Johnson 1913); 2 spms. (USNM). LAKE ALFRED 5-1-50 J.T.Griffiths (Wm. Wirth) (USNM). Two spms. labelled "Florida" (USNM); one spm. labelled "Florida JMAldrich coll. on palm" (USNM).

Baccha nepenthe Hull

BONITA 5-20-32 A.R.Taylor Holotype No. 56423 (USNM); 5-20-32 A.R.Taylor Paratype (USNM); another paratype minus collector's label probably same as other two spms.

Baccha notata Loew

CHARLOTTE HARBOR Mrs.ATS (AMNH). NAPLES S.Rounds (AMNH). BISCAYNE BAY Mrs.ATS (AMNH). KEY LARGO 1-3-51 HVW,Jr. 3 spms.; 3-21-51 HVW,Jr. on *Trema mollis* 10 spms.; 3-21-51 HVW,Jr. on *Trema mollis* 2 spms. (HVW,Jr.) (AMNH); 3-21-51 HVW,Jr. on *Trema mollis* 2 spms. (HVW,Jr.) (CLF coll.).

Baccha scutellata Loew

COCOA July 1944 G.E.Bohart 2 spms. (USNM). LAKE WORTH Mrs.ATS—listed by Johnson (1913) as syn. *Ocyptamus scutellatus* Loew (AMNH). BISCAYNE BAY Mrs.ATS (AMNH).

CERIOIDES Rondani

Cerioides signifera (Loew)

Various records list the Florida spms. as *C.willistoni* Kahl, but this is a syn. of *C.signifera* (Loew). ALACHUA COUNTY 3-4-30 CJGuard FlaFruitFlyTrapSurv. (USNM). INVERNESS February 12 CR; February 14 CR (Johnson 1913). BREVARD COUNTY 4-14-30 J.Howard FlaFruitFlyTrapSurv. (USNM). ORANGE COUNTY 3-29-30 J.E. Sadler FlaFruitFlyTrapSurv. (USNM).

CHEILOSIA Meigen

Cheilosia (Cartosyrphus) prima Hunter

GAINESVILLE 2-22-19 PWF (CLF) (EUM); 2-22-19 PWF (CLF) 2 spms. (CLF coll.); 2-23-19 PWF (FMH); 2-23-19 PWF (CLF); 2-23-19 PWF (CLF) (EUM); 2-23-19 PWF (CLF) 3 spms. (OSU); 2-24-19 PWF (CLF) (OSU).

CHRYSOGASTER Meigen

Chrysogaster (Orthoneura) nitida Wiedemann

ST. AUGUSTINE 4-3-15 CLM (CLM coll.); 4-17-19 CLM (CLM coll.);

March 15 CWJ (Johnson 1913). GAINESVILLE 11-2-19 PWF (HVW,Jr.) 3 spms. (EUM); 2-16-19 PWF (HVW,Jr.) (EUM); 2-22-19 PWF (HVW,Jr.) (EUM); 2-23-19 PWF (HVW,Jr.) 8 spms. (EUM); 2-24-19 PWF (HVW,Jr.) (EUM); 5-8-19 PWF (HVW,Jr.) (EUM); 5-12-19 PWF 2 spms.; 5-13-19 PWF 2 spms.; 5-13-19 PWF (HVW,Jr.) 2 spms. (EUM); 5-14-19 PWF (HVW,Jr.) 12 spms. (EUM); 5-16-19 PWF (HVW,Jr.) 3 spms. (EUM); 5-18-19 PWF (HVW,Jr.) (EUM); 5-23-19 PWF (HVW,Jr.) (EUM); 5-26-19 PWF (HVW,Jr.) 2 spms. (EUM); 5-29-19 PWF (HVW,Jr.) (EUM); 3-16-20 PWF (HVW,Jr.) 13 spms. (EUM); 2-6-21 PWF (HVW,Jr.) 5 spms. (EUM); 2-14-21 PWF (HVW,Jr.) (EUM); 5-10-21 PWF (HVW,Jr.) (EUM). INVERNESS February 14 CR (Johnson 1913). ORLANDO May 16 Mrs.ATS (Johnson 1913). LAKE WALES 3-13-21 PWF (HVW,Jr.) (EUM). TICK ISLAND (location unknown) May 12 CWJ (Johnson 1913). One spm. labelled "Florida" (USNM).

CYNORHINA Williston

Cynorhina notata Wiedemann

JACKSONVILLE Mrs.ATS — labelled *Criorhina notata* (Wied.) (USNM). ALACHUA COUNTY 4-16-41 H.Hixon (FMH).

EPISTROPHE Walker

Allograpta Osten-Sacken is given generic rank by most workers, and virtually all published records are given accordingly. Hull (1949) makes it a subgenus of *Epistrophe*.

Epistrophe (Allograpta) cubana (Curran)

KEY LARGO 1-3-51 HVW,Jr. on *Bidens bipinnata* (CLF,CHC); 3-21-51 HVW,Jr. on *Trema mollis* (CHC); 3-21-51 HVW,Jr. on *Trema mollis* (AMNH); 3-21-51 HVW,Jr. on *Trema mollis* (CLF coll.).

Epistrophe (Allograpta) exotica (Wiedemann)

FT. MYERS 1-10-33 W.M.B. (det. RCO as syn. *A.fracta* Osten-Sacken) (OSU). MIAMI (CHC).

Epistrophe (Allograpta) obliqua (Say)

JACKSONVILLE (USNM). ST. AUGUSTINE 4-18-19 CLM (CLM coll.). GAINESVILLE 1914 (FMH) (THH coll.); 1-28-18 PWF (CLF) (EUM); 2-22-19 PWF (CLF) (EUM); 2-23-19 PWF (CLF) 2 spms. (EUM); 2 spms. (RCO coll.) (OSU); 3-24-36 (FMH) (THH coll.); 10-22-38 (FMH) (THH coll.); 1-24-41 (FMH) (THH coll.); 4-16-41 H.Hixon (FMH) (THH coll.); 11-15-41 (FMH) (THH coll.); 1946 (FMH) (THH coll.); 1-18-47 (FMH) (THH coll.); 10-23-47 HVW,Jr. on *Bidens bipinnata* (FMH); 11-7-47 HVW,Jr. on *Bidens bipinnata* (FMH) 5 spms.; 12-3-47 HVW,Jr. on *Bidens bipinnata* (FMH) 3 spms.; 12-8-47 HVW,Jr. on *Bidens bipinnata* (FMH) 7 spms.; 12-9-47 HVW,Jr. on *Bidens bipinnata* (FMH) 6 spms.; 12-9-47 HVW,Jr. on *Citrus* sp. (FMH) 6 spms.; 12-10-47 HVW,Jr. on *Bidens bipinnata* (FMH) 2 spms.; 1-23-48 HVW,Jr. on *Brassica* sp. (FMH) 7 spms.; 2-17-48 HVW,Jr. on *Cercis canadensis* (FMH) 9 spms.; 2-18-48 HVW,Jr. on *Prunus*

myrtifolia (FMH) 2 spms.; 2-25-48 HVW,Jr. on *Prunus* sp. (FMH) 5 spms. DAYTONA 4-8-19 CLM (CLM coll.). ENTERPRISE March 30 - May 10 (USNM). ORLANDO 6-1-07 (Russell coll.) Bred on *Aphis gossypii* (USNM); 6-5-07 (Russell coll.) Bred on *Aphis gossypii* on watermelon (USNM). HIGHLANDS HAMMOCK STATE PARK 3-24-51 HVW,Jr. SEBRING 3-23-51 HVW,Jr. on *Ximenia americana;* 3-25-51 HVW,Jr. on *Litchi chinensis* 3 spms. PUNTA GORDA 11-11-11 (AMNH). CLEWISTON 12-29-50 HVW,Jr. on *Bidens bipinnata* 2 spms. FT. MYERS 1-10-33 W.M.B. (OSU); 1-11-33 (RCO coll.) (OSU). MIAMI 1-4-51 HVW,Jr. on *Bidens bipinnata* 5 spms.; 4-8-09 (Russell coll.) Bred on aphids 2 spms. (USNM); 4-16-09 (Russell coll.) Bred on aphids (USNM); 4-22-09 (Russell coll.) Bred on aphids (USNM); 4-27-09 (Russell coll.) Bred on aphids (USNM). FLORIDA CITY 3-21-51 HVW,Jr. on *Galium triflorum* 4 spms.; 3-21-51 HVW,Jr. on *Bidens bipinnata* 2 spms.; 3-21-51 HVW,Jr. sweeping grasses. COCONUT GROVE 1-31-20 S.B.Walker on *Cocos nucifera* (FMH). FLORIDA December F.H.Snow (CLM coll.); adult and pupal case (Wm.H.Ashmead coll.) (USNM).

Epistrophe (Mercurymyia) jactator (Loew)

BISCAYNE BAY Mrs.ATS—labelled *Baccha jactator* (Loew) (USNM).

ERISTALIS Latreille

USNM recognizes *Tubifera* Meigen (1800) in preference to *Eristalis* Latreille (1804).

Eristalis agrorum (Fabricius)

ST. AUGUSTINE 4-19-19 CLM—labelled *Eristalis cubensis,* syn. (CLM coll.); 4-21-19 CLM 2 spms.—labelled *Eristalis cubensis* (CLM coll.). GAINESVILLE 4-25-19 PWF (HST) (EUM); 5-13-19 PWF (HST) (EUM); 1940 on *Bidens bipinnata* (HST) 4 spms. (OSU); 12-6-46 (FMH) (D.J.Borror coll.) (OSU); 10-20-47 HVW,Jr. on *Bidens bipinnata* (FMH); 10-27-47 HVW,Jr. on *Bidens bipinnata* (FMH); 11-7-47 HVW,Jr. on *Bidens bipinnata* (FMH) 2 spms. (THH coll.); 12-3-47 HVW,Jr. on *Bidens bipinnata* (FMH) 2 spms.; 12-3-47 HVW,Jr. on *Bidens bipinnata* (FMH) (THH coll.); 12-7-47 HVW,Jr. on *Bidens bipinnata;* 12-8-47 HVW,Jr. (FMH) 4 spms. (M.T.James coll.); 12-8-47 HVW,Jr. on *Bidens bipinnata* 11 spms.; 12-8-47 HVW,Jr. on *Bidens bipinnata* (FMH) 9 spms.; 12-8-47 HVW,Jr. on *Bidens bipinnata* (FMH) 2 spms. (THH coll.); 12-9-47 HVW,Jr. on *Bidens bipinnata* (FMH); 12-9-47 HVW,Jr. on *Citrus* sp. (FMH) (THH coll.); 12-9-47 HVW,Jr. on *Bidens bipinnata* (FMH) (THH coll.); 12-10-47 HVW,Jr. on *Bidens bipinnata* (FMH) 6 spms.; 12-10-47 HVW,Jr. on *Bidens bipinnata* (FMH) 5 spms. (THH coll.); 12-17-47 HVW,Jr. on *Bidens bipinnata* (FMH); 12-17-47 HVW,Jr. on *Bidens bipinnata* 2 spms. (THH coll.); 3-19-48 HVW,Jr. on *Ceanothus* sp. (FMH) 2 spms. ALACHUA COUNTY 12-12-41 (FMH) 2 spms. (THH coll.); December 1941 (FMH) (THH coll.). SANFORD 5-7-08 Van Duzee 2 spms. (OSU). HIGHLANDS HAMMOCK STATE PARK 3-27-50 HVW,Jr. 2 spms. SEBRING 2-21-48 HVW,Jr. on *Prunus myrtifolia* (FMH) 2 spms.; 6-9-49 HVW,Jr. on *Bidens bipinnata;* 6-13-49 HVW,Jr. on

Bidens bipinnata; 7-30-49 HVW,Jr. (FMH) (D.J.Borror coll.) (OSU); 7-30-49 HVW,Jr.; 12-31-49 HVW,Jr. on *Bidens bipinnata* 2 spms.; 3-19-51 HVW,Jr. on *Bidens bipinnata* 3 spms.; 3-20-51 HVW,Jr. on *Bidens bipinnata;* 3-20-51 HVW,Jr. on *Itea virginica* 2 spms.; 3-20-51 HVW,Jr. on *Itea virginica* (HVW,Jr.) (AMNH); 3-25-51 HVW,Jr. on *Litchi chinensis*. LAKE PLACID 12-26-50 HVW,Jr. on *Bidens bipinnata* 2 spms.; 3-20-51 HVW,Jr. on *Itea virginica* 2 spms.; 3-20-51 HVW,Jr. on *Itea virginica* (HVW,Jr.) (AMNH). PUNTA GORDA 11-16-11 (RCO coll.) 4 spms. (OSU); 11-17-11 (RCO coll.) 2 spms. (OSU). PAHOKEE 4-25-19 PWF (HST) (EUM). CLEWISTON 12-29-50 HVW,Jr. on *Bidens bipinnata* 41 spms.; 12-29-50 HVW,Jr. on *Bidens bipinnata* 2 spms. (HVW,Jr.) (AMNH). FT. MYERS 11-13-11 (RCO coll.) (OSU); 11-15-11 (RCO coll.) 4 spms. (OSU); 1-1-33 (RCO coll.) (HST) (OSU). EVERGLADES 4-10-12 W.T.Davis (OSU). MIAMI 1-4-51 HVW,Jr. on *Bidens bipinnata* 13 spms.; 2-10-? labelled *Eristalis cubensis* Macq. (ANSP). CRESCENT CITY 4-20-08 Van Duzee (OSU). SOUTH FLORIDA March 1923 JSH 2 spms. (OSU).

Eristalis albifrons Wiedemann

ST. AUGUSTINE F.H.Genung (Johnson 1913). ORLANDO February 21 CR (Johnson 1913). GEORGIANA Wm.Wittfeld (Johnson 1913). LAKELAND 5-5-12 (RCO coll.) (OSU); May 6 W.T.Davis (Johnson 1913). CHARLOTTE HARBOR Mrs.ATS (Johnson 1913). BELLE GLADE 11-27-40 D.J.Taylor (USNM). LAKE WORTH (Johnson 1913). FT. MYERS 1-2-51 HVW,Jr. on *Flaveria linearis*. EVERGLADES 4-7-12 W.T.Davis (HST) 2 spms. (OSU); April 7 (Johnson 1913); 4-7-22 W.T.Davis (OSU). CHOKOLOSKEE 1929 Brooklyn Mus. coll. (USNM); March (RCO coll.) (OSU); May (RCO coll.) (OSU); (Johnson 1913). MIAMI 1-25-09 (USNM); 1-4-51 HVW,Jr. on *Bidens bipinnata;* 2-10-51 2 spms. (ANSP); February 18 P.Laurent (Johnson 1913). BISCAYNE BAY Mrs.ATS (Johnson 1913). HOMESTEAD 12-1-18 CAM 17 spms. (USNM). ROYAL PALM STATE PARK March R.M.Jones (ANSP). KEY LARGO 1-3-51 HVW,Jr. on *Bidens bipinnata* 4 spms.; 1-3-51 HVW,Jr. on *Bidens bipinnata* (HVW,-Jr.) 2 spms. (AMNH). FLORIDA (USNM).

Eristalis dimidiatus Wiedemann

PENSACOLA 10-11-14 (AMNH). PORT ST. JOE 8-19-45 H.T.Spieth. ST. AUGUSTINE (Johnson 1913). ALACHUA COUNTY 4-16-41 H.Hixon (FMH). GAINESVILLE 194? (RCO,FMH) (THH coll.); 1-20-47 HVW,Jr. on *Bidens bipinnata* (FMH); 10-20-47 HVW,Jr. on *Bidens bipinnata* (FMH) (THH coll.); 11-2-18 PWF (CLF) (OSU); 11-10-18 PWF (HST) (EUM); 12-10-47 HVW,Jr. on *Bidens bipinnata* (FMH) 2 spms. NEWBERRY November 18 (Johnson 1913). PUNTA GORDA November 16 W.T.Davis (Johnson 1913).

Eristalis latifrons Loew

TAMPA 2 spms. (USNM).

Eristalis saxorum Wiedemann

PORT ST. JOE 3 spms. (AMNH). JACKSONVILLE 3 spms. (AMNH). GAINESVILLE 7-22-18 PWF (HST) (EUM); 5-8-21 PWF (HST) (EUM).

Eristalis (Eristalomyia) tenax (Linnaeus)

GAINESVILLE 12-10-47 HVW,Jr. on *Bidens bipinnata* (FMH) (THH coll.); 3-14-48 HVW,Jr. on *Pyrus* sp. (FMH) 3 spms.

Eristalis transversus Wiedemann

ST. AUGUSTINE March 15 (Johnson 1913). GAINESVILLE 194? (RCO,FMH) (THH coll.); 2-24-19 PWF (CLF) 2 spms. (EUM); 5-8-19 PWF (CLF) (EUM); 5-23-19 PWF (CLF) 3 spms. (EUM); 1-20-47 HVW,Jr. on *Bidens bipinnata* (FMH); 12-10-47 HVW,Jr. on *Bidens bipinnata* (FMH); 12-10-47 HVW,Jr. on *Bidens bipinnata* (FMH) (THH coll.). INVERNESS March 14 CR (Johnson 1913). ORLANDO 3-20-35 (RCO coll.) (OSU). FLORIDA (USNM).

Eristalis vinetorum Fabricius

JACKSONVILLE (USNM); June 30 (ANSP); September R.L.Blickle (OSU). ST. AUGUSTINE CWJ (Johnson 1913); 2 spms. (ANSP). ALACHUA COUNTY 12-10-37 (FMH); 10-19-39 (FMH) (THH coll.). GAINESVILLE 6-16-18 PWF (HST) (THH coll.); 6-29-18 PWF (HST) (THH coll.); 7-7-18 PWF (HST) (EUM); 7-16-18 PWF (HST) (EUM); 11-7-47 HVW,Jr. on *Bidens bipinnata* (FMH). ORLANDO 6-8-15 (ANSP). TAMPA 12-14-49 HVW,Jr. on *Bidens bipinnata* 3 spms. HIGHLANDS HAMMOCK STATE PARK 12-23-50 HVW,Jr. SEBRING 6-13-49 HVW,Jr. on *Bidens bipinnata;* 12-24-49 HVW,Jr. on *Helianthus* sp. 2 spms.; 12-31-49 HVW,Jr. on *Bidens bipinnata;* 12-23-50 HVW,Jr. on *Bidens bipinnata* 2 spms. CLEWISTON 12-29-50 HVW,Jr. on *Bidens bipinnata.* PUNTA GORDA November 16 W.T.Davis (Johnson 1913). LAKE WORTH Mrs.ATS (Johnson 1913). FT. MYERS 1-1-33 W.M.B. (HST) 2 spms. (OSU). MIAMI 2-10-? 2 spms. (ANSP); 8-12-15 (ANSP); CHTT 9 spms. (USNM); 1-4-51 HVW,Jr. on *Bidens bipinnata* 7 spms. BISCAYNE BAY Mrs.ATS 2 spms. (AMNH). DADE COUNTY 5-12-39 D.J.&J.N.Knull (HST) (OSU). ROYAL PALM STATE PARK 10-11-17 CAM 4 spms. (USNM); April 12-18 13 spms. (AMNH). KEY LARGO 1-3-51 HVW,Jr. on *Bidens bipinnata.* KEY WEST 10-16-31 O.D.Link (FMH). FLORIDA 6 spms. (USNM); C.V.Riley 4 spms. (USNM).

Eristalis n.sp.

JACKSONVILLE Mrs.ATS (USNM). GAINESVILLE 3-19-48 HVW,-Jr. on *Ceanothus* sp. (FMH). This species is related to *E.texanus* Hull, but is distinct. CLEWISTON 12-29-50 HVW,Jr. on *Bidens bipinnata* (CHC).

HELOPHILUS Meigen

Helophilus anniae Brimley

JACKSONVILLE Mrs.ATS (AMNH). ALACHUA COUNTY 4-17-35 (RCO)—labelled *Parhelophilus anniae* (Brimley) (OSU).

Helophilus fasciatus Walker

ALACHUA COUNTY 11-6-21 (FMH) (M.T.James coll.); 9-19-37 (FMH); 9-19-37 (FMH) (THH coll.); 10-5-39 (FMH) (THH coll.); 11-29-41 (FMH). ST. AUGUSTINE CWJ—listed as syn. *H.similis* Macq. (Johnson 1913). GAINESVILLE 12-10-47 HVW,Jr. on *Bidens bipinnata* (FMH) (THH coll.); 12-10-47 HVW,Jr. (FMH) 2 spms.; 12-17-47 HVW,Jr. (FMH). INVERNESS February 12 CR—listed by Johnson (1913) as syn. *H.similis*. TITUSVILLE November 8—listed by Johnson (1913) as syn. *H.similis*. SEBRING 12-21-46 HVW,Jr. (FMH) (M.T.James coll.). LAKE WORTH March Mrs.ATS—listed by Johnson (1913) as syn. *H.similis*.

Helophilus latifrons Loew

GAINESVILLE 194? (RCO,FMH).

MALLOTA Meigen

Mallota bautias (Walker)

GAINESVILLE 4-9-19 PWF (CLF) (OSU); 4-27-36 (FMH); 3-7-48 HVW,Jr. (FMH); 3-18-48 HVW,Jr. (FMH) (det. FMH in 1948 to be *M.cimbiciformis* Fallén); Curran 1951 states that *M.cimbiciformis* does not occur in America, so *M.cimbiciformis* of American authors is a syn. of *M.bautias* (Walker). INVERNESS February 12 CR (Johnson 1913).

Mallota facialis Hunter

GAINESVILLE 2-25-48 HVW,Jr. on *Prunus* sp. (det. in 1948 by FMH as *M.cimbiciformis).*

Mallota posticata (Fabricius)

JACKSONVILLE (USNM). GAINESVILLE 3-16-48 HVW,Jr. on *Pyrus* sp. (FMH).

MEROMACRUS Rondani

Meromacrus acutus (Fabricius)

JUNIPER CREEK May 15 CWJ—listed by Johnson (1913) as syn. *M.crucifera* (Macq.). GUNNTOWN, Levy County, 5 spms. (ANSP). ST. AUGUSTINE May 15 (Johnson 1913) (USNM). ALACHUA COUNTY 4-1-34 (FMH); 4-29-38 H.Hixon (FMH); 1934 (FMH); 5-6-40 H.Hixon (FMH). GAINESVILLE 19? (FMH); (RCO coll.) 4 spms. (OSU); 6-29-18 PWF (CLF) (EUM); 7-7-18 PWF (CLF); 7-18-18 PWF (FMH) (M.T.James coll.) 7-18-18 PWF (CLF) 2 spms. (AMNH); 5-19-19 PWF (CLF) (EUM); 1934 (FMH) (M.T.James coll.). PUTNAM COUNTY 2-23-32 Mark Dodd Reared from rotten wood of Sable palmetto—pupal case with imago (USNM). ENTERPRISE March 30 & May 10 E.Daecke (AMNH); May 13 (USNM). LAKE APOPKA 5-12-40 E.L.Bell (AMNH). ORLANDO 3-25-? (AMNH). GOTHA March 1896 W.M.Wheeler (AMNH). LAKELAND May 6 W.T.Davis (Johnson 1913). BELLEAIR Mrs.ATS (AMNH). VERO BEACH May 1942 J.R.Malloch (USNM). HIGH-

LANDS HAMMOCK STATE PARK 3-27-51 HVW,Jr. on *Cornus stricta*. SEBRING 3-23-51 HVW,Jr. on *Ximenia americana*. FT. DRUM November A.Fredholm (USNM). CHARLOTTE HARBOR Mrs.ATS (Johnson 1913). JUPITER 3-20-45 W.Procter (AMNH). CHOKOLOSKEE May (RCO coll.) 2 spms. (OSU). MIAMI November 12 CHTT (USNM); November 12 CHTT (OSU); April 11-21 1923 (AMNH). BISCAYNE BAY Mrs.ATS 2 spms. (AMNH) (Johnson 1913). ROYAL PALM STATE PARK April 12-18 1923 (AMNH). PARADISE KEY, Royal Palm State Park, 5-13-18 CAM (USNM); 4-10-19 CAM (USNM). FLORIDA CWJ (USNM); CLM (OSU); (RCO coll.) (OSU).

Meromacrus ruficrus (Wiedemann)

INDIAN RIVER (ANSP). HIGHLANDS HAMMOCK STATE PARK 3-27-50 HVW,Jr. on *Ilex cassine*. CHOKOLOSKEE (Johnson 1913). MIAMI 10-30-? CHTT (OSU). BISCAYNE BAY Mrs.ATS 3 spms. (AMNH); Mrs.ATS (Johnson 1913); Mrs.ATS (OSU).

MESOGRAMMA Loew

Mesogramma arethusa Hull

GAINESVILLE 2-17-32 Geo. Swank (FMH); 2-17-48 HVW,Jr. on *Cercis canadensis* (FMH); 3-19-48 HVW,Jr. on *Ceanothus* sp. (FMH) 2 spms.; 3-19-48 HVW,Jr. (FMH) (M.T.James coll.). ENGLEWOOD J.G.Needham—Holotype and Allotype. MIAMI 1-4-51 HVW,Jr. on *Bidens bipinnata* 2 spms.

Mesogramma basilaris Wiedemann

MIAMI (ANSP).

Mesogramma boscii Macquart

PANAMA CITY 7-22-20 (CLF). PEBBLY BEACH, Jacksonville, 5-9-08 (AMNH). ST. AUGUSTINE 4 spms. (ANSP); (CWJ) 3 spms. (USNM); 4-14-19 (CLM) (CLM coll.) 3 spms. 4-16-19 CLM (CLM coll.); 4-17-19 CLM (CLM coll.). CRESCENT CITY 4-19-08 Van Duzee (AMNH); 4-22-08 Van Duzee (AMNH); 4-25-08 Van Duzee (AMNH); October 15-16 1914 (AMNH). ORLANDO 3-20-35 RCO (CLF). CLEARWATER 4-29-08 Van Duzee (CHC) 6 spms. (AMNH); 4-30-08 Van Duzee (AMNH); 5-1-08 Van Duzee 2 spms. (AMNH). LAKELAND 11-10-11 2 spms. (AMNH). CHARLOTTE HARBOR Mrs.ATS (CHC); Mrs.ATS 2 spms. (AMNH). ST. PETERSBURG 4-28-08 Van Duzee (AMNH). HIGHLANDS HAMMOCK STATE PARK 3-24-51 HVW,Jr.; 3-27-51 HVW,Jr. FT. MYERS 11-13-11 (AMNH); 1-1-33 W.M.B. (OSU); 1-1-33 (RCO coll.) 3 spms. (OSU). LaBELLE 11-14-11 (AMNH). MIAMI 11-5-11 (AMNH); 1-4-51 HVW,Jr. on *Bidens bipinnata* (CHC). BISCAYNE BAY Mrs.ATS 4 spms. (USNM). FLORIDA CITY 3-21-51 HVW,Jr. on *Bidens bipinnata* (CHC); 3-21-51 HVW,Jr. on *Galium triflorum* (CHC) 4 spms.; 3-21-51 HVW,Jr. sweeping grasses (CHC) 4 spms.; 3-21-51 HVW,Jr. on *Galium triflorum* (CLF); 3-21-51 HVW,Jr. on *Bidens bipinnata* (CLF) 4 spms.; 3-21-51 HVW,Jr. on *Bidens bipinnata* (CLF) (CLF coll.); 3-21-51 HVW,Jr. on *Bidens bipinnata* 4 spms.; 3-21-51 HVW,Jr.

on *Galium triflorum* 2 spms.; 3-21-51 HVW,Jr. sweeping grasses. MONROE COUNTY 3-19-51 E.L.Sleeper (CLF); 3-19-51 HVW,Jr. FLORIDA FHB (USNM); J.M.Aldrich 3 spms. (USNM).

Mesogramma floralis Fabricius

ST. AUGUSTINE May 20 (CWJ) (Johnson 1913). ALACHUA COUNTY 10-5-37 (FMH); 10-5-37 (FMH) (THH coll.). GAINESVILLE 11-7-47 HVW,Jr. (CLF); 12-3-47 HVW,Jr. on *Bidens bipinnata* (FMH); 12-9-47 HVW,Jr. on *Bidens bipinnata* (FMH); 12-10-47 HVW,Jr. on *Bidens bipinnata* (FMH); 12-10-47 HVW,Jr. (FMH) (M.T.James coll.). LAKE MARY J.T.Griffith (Johnson 1913). CLEWISTON 12-29-50 HVW,Jr. on *Bidens bipinnata* 3 spms. MIAMI 1-4-51 HVW,Jr. on *Bidens bipinnata*. BISCAYNE BAY Mrs.ATS (Johnson 1913)—listed as *M.duplicata* Wied. according to Curran, 1934, this spm. is *M.florale* Fabr. FLORIDA CITY 3-21-51 HVW,Jr. sweeping grasses (CHC) 2 spms.; 3-21-51 HVW,Jr. on *Bidens bipinnata* (CHC) 2 spms.; 3-21-51 HVW,Jr. on *Galium triflorum* 2 spms. (CHC); 3-21-51 HVW,Jr. on *Galium triflorum* (det. CHC as *M.floralis* ?—black femora.); 3-21-51 HVW,Jr. on *Bidens bipinnata* (CLF) 4 spms.; 3-21-51 HVW,Jr. on *Galium triflorum* (CLF); 3-21-51 HVW,Jr. sweeping grasses (CLF) 2 spms. KEY LARGO 1-3-51 HVW,Jr. GRASSY KEY 1-3-51 HVW,Jr.

Mesogramma marginata (Say)

DeFUNIAK SPRINGS March 1 (Johnson 1913). JACKSONVILLE 11-3-11 4 spms. (AMNH); November 3 (Johnson 1913). ST. AUGUSTINE 4-12-19 CLM 2 spms. (CLM coll.); May (CWJ) (Johnson 1913). ALACHUA COUNTY 4-20-38 (THH coll.). GAINESVILLE 1914 (AMNH); 194? (RCO,FMH) (THH coll.); 12-3-47 HVW,Jr. on *Bidens bipinnata* (FMH); 12-9-47 HVW,Jr. on *Bidens bipinnata* (FMH); 12-17-47 HVW,Jr. on *Bidens bipinnata* (FMH); 12-17-47 HVW,Jr. on *Bidens bipinnata* (FMH) (THH coll.). INVERNESS March 9 CR (Johnson 1913). ORLANDO February 21 CR (Johnson 1913). LAKE WORTH March Mrs.ATS (Johnson 1913). MONROE COUNTY 3-19-51 E.L.Sleeper (CHC); 3-19-51 E.L.Sleeper (CLF). FLORIDA F.H.B. (USNM); (USNM).

Mesogramma mutuum Say

MONROE COUNTY 3-19-51 E.L.Sleeper (CHC).

Mesogramma parvula Loew

ST. AUGUSTINE May 20 (Johnson 1913). LAKE MARY March J.T.Griffith (Johnson 1913). BISCAYNE BAY Mrs.ATS (CWJ)—listed by Johnson (1913) as syn. *Toxomerus parvula* Loew.

Mesogramma planiventris Loew

CRESCENT CITY April (CWJ)—listed by Johnson (1913) as syn. *Toxomerus planiventris* Loew. SANFORD 4-30-26 J.A.Reeves (CHC). TITUSVILLE November 8 (CWJ)—listed by Johnson (1913) as syn. *Toxomerus planiventris* Loew. LAKELAND November 10 (CWJ)—listed by Johnson (1913) as syn. *Toxomerus planiventris* Loew. CLEAR-

WATER May 1 (CWJ)—listed by Johnson (1913) as syn. *Toxomerus planiventris* Loew. PUNTA GORDA November 11 (CWJ)—listed by Johnson (1913) as syn. *Toxomerus planiventris* Loew. LaBELLE November 14 (CWJ)—listed by Johnson (1913) as syn. *Toxomerus planiventris* Loew. BISCAYNE BAY Mrs.ATS (CWJ)—listed by Johnson (1913) as *Toxomerus duplicatus* Wied., and subsequently det. CHC as *M.planiventris* Loew.

Mesogramma polita (Say)

DeFUNIAK SPRINGS 10-17-14 (AMNH). JACKSONVILLE November 3 W.T.Davis (CWJ) (Johnson 1913). ST. AUGUSTINE May 9 (CWJ)—listed by Johnson (1913) as syn. *Toxomerus politus* Say. ALACHUA COUNTY 5-13-34 (RCO) (THH coll.); 10-28-37 (FMH) (THH coll.); October 1939 (FMH) (THH coll.); 5-5-41 (FMH) (THH coll.); 11-29-41 (FMH). GAINESVILLE 11-6-46 HVW,Jr. (CLF); 5-25-48 HVW,Jr. on squash blossom (FMH). GEORGETOWN May 9 (CWJ) (Johnson 1913). TITUSVILLE November 8 (Johnson 1913). HIGHLANDS HAMMOCK STATE PARK 12-23-50 HVW,Jr. 4 spms. CLEWISTON 12-29-50 HVW,Jr. on *Bidens bipinnata* 3 spms. MIAMI 1-4-51 HVW,Jr. on *Bidens bipinnata* 2 spms. FLORIDA (USNM).

Mesogramma slossonae Curran

BISCAYNE BAY Mrs.ATS Holotype (AMNH).

Mesogramma subannulata Loew

ST. AUGUSTINE 4-18-19 (CLF,CHC). BISCAYNE BAY Mrs.ATS —listed by Johnson (1913) as syn. *Toxomerus subannulatus* Loew. FLORIDA CITY 3-21-51 HVW,Jr. sweeping grasses (CHC).

Mesogramma n.sp.

HIGHLANDS HAMMOCK STATE PARK 3-24-51 HVW,Jr. (CHC—n.sp., near *M.verticalis);* 3-24-51 HVW,Jr. on *Cornus stricta* (CHC—n.sp., near *M.verticalis)* 3 spms.; 3-27-51 HVW,Jr. (CLF) 3 spms.; 3-27-51 HVW,Jr. on *Ilex glabra* (CLF). FLORIDA CITY 3-21-51 HVW,Jr. on *Bidens bipinnata;* 3-21-51 HVW,Jr. on *Galium triflorum.*

Mesogramma n.sp.?

MIAMI 1-4-51 HVW,Jr. on *Bidens bipinnata* (CHC—probably n.sp., male needed). This female seems near *M.boscii.*

METASYRPHUS Matsumura

Metasyrphus emarginatus (Say)

WILLISTON, Synopsis, 1886, lists the species [labelled *Xanthogramma emarginata* (Say)]—Florida April 20 1874 C.V.Riley. Found under bark of cotton tree.

Metasyrphus (Eupeodes) volucris (Osten-Sacken)

An empty pupal case bearing locality label "Orlando, Fla." is identified as *E.volucris* O.S. (USNM), but I am confident that this is an error.

Metasyrphus wiedemanni (Johnson)

JACKSONVILLE April 15 Mrs.ATS [det. Johnson (1913) as syn. *Syrphus americanus* Wied.]. ATLANTIC BEACH Mrs.ATS [det. Johnson (1913) as syn. *Syrphus americanus* Wied.]. ST. AUGUSTINE 4-17-19 CLM (CLM coll.); 4-21-19 CLM (CLM coll.). ALACHUA COUNTY 19? (RCO); 19? (FMH); 4-15-35 (FMH); 12-15-38 (FMH); 10-15-46 (FMH). GAINESVILLE (RCO coll.) (OSU); 3-16-32 (FMH); 4-9-36 John T. Creighton (FMH); 10-17-47 HVW,Jr. on *Pyrus* sp.; 12-16-47 HVW,Jr. on *Lupinus* sp. (FMH) 2 spms.; 2-17-48 HVW,Jr. on *Cercis canadensis* (FMH) 3 spms.; 3-14-48 HVW,Jr. on *Pyrus* sp. (FMH). DAYTONA 4-7-19 CLM (CLM coll.). INVERNESS February 12 CR [det. Johnson (1913) as syn. *Syrphus americanus* Wied.]. ORLANDO February 21 CR [det. Johnson (1913) as syn. *Syrphus americanus* Wied.] 12-26-07 Russell (USNM); 3-27-08 Russell (USNM); 3-3-37 M.R.Osburn Reared from larvae fed on green citrus aphid 2 spms. (OSU). LAKE WORTH Mrs.ATS 2 spms. (AMNH). BISCAYNE BAY Mrs.ATS [det. Johnson (1913) as syn. *Syrphus americanus* Wied.].

MICRODON Meigen

Microdon (Omegasyrphus) baliopterus (Loew)

CHARLOTTE HARBOR Mrs.ATS (Johnson 1913)—listed in first Johnson list as *Omegasyrphus baliopterus* Loew.

Microdon (Omegasyrphus) coarctatus (Loew)

ORLANDO March 16 CR—listed in first Johnson list (1913) as *Omegasyrphus coarctatus* Jones.

Microdon (Eumicrodon) fulgens Wiedemann

SUWANEE Mrs.ATS (Johnson 1913). ST. AUGUSTINE (ANSP); Pupae found in decaying pine logs (CWJ) (Johnson 1913). GAINESVILLE (OSU); 6-3-18 PWF (FMH) (EUM); 7-18-18 PWF (CLF) (OSU); 5-23-19 PWF (CLF) (EUM); 6-10-21 PWF (CLF) (EUM). ALACHUA COUNTY 11-1-39 (FMH). ENTERPRISE May 13 H.G.Hubbard (AMNH). SEMINOLE COUNTY 7-18-29 C.Nelson FlaFruitFlyTrapSurv. ORANGE COUNTY 6-24-29 M.M.Smith,Jr. FlaFruitFlyTrapSurv. PLANT CITY 8-15-30 R.H.Beamer (AMNH). LONG KEY 4-19-23 (AMNH). DEEP LAKE April 15 (Johnson 1913). MARCO 4-20-14 (AMNH); April 20 (Johnson 1913). MIAMI October 22 CHTT (USNM). BISCAYNE BAY Mrs.ATS (Johnson 1913). ROYAL PALM STATE PARK 4-12-23 (AMNH); 3-24-29 (AMNH). PARADISE KEY, Royal Palm State Park, 6 spms. (AMNH); (USNM); 9-22-18 CAM (AMNH); 10-3-19 CAM (AMNH). FLORIDA 1921 Mayport (AMNH); 5 spms. JM (USNM).

Microdon fuscipennis Macquart

JACKSONVILLE (Wm.H.Ashmead coll.) (USNM). GOTHA (W.M. Wheeler coll.) (AMNH). GEORGIANA July 17 Wm.Wittfeld (Johnson 1913).

Microdon globosus (Fabricius)

CRESCENT CITY April 21 (Johnson 1913). TITUSVILLE November 8 (Johnson 1913). FLORIDA S.W.Williston (USNM); 3 spms. (USNM); 7-1-1882 Wm.Wittfeld (USNM).

Microdon limbus Williston

This species may be syn. of *M.rufipes* Macquart. JACKSONVILLE April Mrs.ATS (AMNH); (Wm.H.Ashmead coll.) (USNM); April Mrs.ATS (Johnson 1913). KENANSVILLE (AMNH). FT. MYERS 4-3-38 D.M.DeLong (RCO) (OSU). FLORIDA Mrs.ATS 3 spms. (AMNH); Morrison Type No. 794 (USNM); (C.V.Riley coll.) (USNM).

Microdon pachystylum Williston

ST. AUGUSTINE (CWJ) (Johnson 1913); (ANSP)—I have not seen this specimen, but suspect it to be *M.fuscipennis* Macq.

Microdon pseudoglobosus Curran

PARADISE KEY, Royal Palm State Park, April 10 J.N.Knull (AMNH).

Microdon scitulus Williston

CAPRON (location unknown) 4-9-? (USNM); 4-19-? (USNM). BISCAYNE BAY Mrs.ATS (Johnson 1913). FLORIDA Morrison Type No. 797 (USNM); (USNM).

Microdon scutifer Knab

HILLIARD 7-24-39 R.H.Beamer 2 spms. (AMNH).

Microdon tristis Loew

BISCAYNE BAY March Mrs. ATS (Johnson 1913).

Microdon viridis Townsend

WDHunter records in *The Canadian Entomologist*, vol. 29, No. 6, June 1897, p. 123: "I found recently in the collecting of the Kansas State University another specimen of this species which I have ascertained was taken by Chas. Robertson, Orlando, Fla., March 16, 1887." Hunter also reports a specimen from Knoxville, Tenn.

MILESIA Latreille

Milesia scutellata Hull

JACKSONVILLE Mrs.ATS (AMNH). ALACHUA COUNTY 3-23-36 (FMH); 5-7-36 (FMH) (M.T.James coll.). GAINESVILLE 194? (FMH); (RCO coll.) (OSU). ORMOND Mrs.ATS (AMNH); Mrs.ATS (CHC); 3-25-? (AMNH). INDIAN RIVER (ANSP)—misidentified as *M.virginiensis;* (USNM). ORLANDO March 1944 R.&G.Bohard (HVW,Jr.) 2 spms. GOTHA March 1896 W.M.Wheeler 6 spms. (AMNH). MARCO 4-19-12 (AMNH). FLORIDA 5 spms. (ANSP); Seifert (AMNH); H.Edwards (AMNH); 6 spms. (ANSP)—misidentified as *M.virginiensis;* (FMH) Paratype (OSU).

Milesia virginiensis (Drury)

WILLISTON (1886) lists species from Florida as syn. *Milesia ornata* Fabr. JUNIPER CREEK May 15 (Johnson 1913). JACKSONVILLE Mrs.ATS (AMNH). ST. AUGUSTINE 4-19-19 CLM (CLM coll.); 4-19-19; May 22 (Johnson 1913); 4-19-19. ALACHUA COUNTY 19? (FMH) (THH coll.); April 1934 (RCO) (THH coll.); 11-13-37 (FMH) (THH coll.). GAINESVILLE 6-16-18 PWF (CLF) (EUM); 10-26-18 PWF (CLF) (EUM); 11-2-18 PWF (CLF) 2 spms. (EUM); 2-16-19 PWF (CLF) (EUM); 2-23-19 PWF (CLF) 7 spms. (EUM); 2-24-19 PWF (CLF) 2 spms. (EUM); 4-10-19 PWF (CLF) (EUM); 5-18-19 PWF (CLF) 5 spms. (EUM); 5-19-19 PWF (CLF) 12 spms. (EUM); 5-23-19 PWF (CLF) 7 spms. (EUM); 5-29-19 PWF (CLF) 2 spms. (EUM); 2-6-21 PWF (CLF) 3 spms.; (RCO coll.) 2 spms. (OSU); (RCO coll.) (HVW,Jr.). ORMOND Mrs.ATS (AMNH). HIGHLANDS HAMMOCK STATE PARK 3-27-50 HVW,Jr. on *Ilex glabra* 2 spms. ENTERPRISE March 30 to May 10 1904 E.Daecke (AMNH); May 11 ? (USNM). INVERNESS March 12 CR (Johnson 1913); April 5 CR (Johnson 1913). GEORGIANA Wm.Wittfeld (Johnson 1913). LAKELAND 5-6-12 W.T.Davis 2 spms. (OSU). PUTNAM COUNTY 7-21-38 H.Hixon (FMH). EVERGLADE April 7 W.T.Davis (Johnson 1913). BISCAYNE BAY Mrs.ATS (Johnson 1913). FLORIDA Aldrich (USNM); (S.W.Williston coll.) (USNM); on palm (USNM); May 1903 (RCO coll.) 2 spms. (OSU); (RCO coll.) (OSU).

MIXOGASTER Macquart

Mixogaster breviventris Kahl

TAMPA 8-4 (or 4-8-?) H.G.Hubbard (USNM).

MONOCEROMYIA Shannon

Monoceromyia tricolor (Loew)

FLORIDA Type No. 48117 (USNM).

MYIOLEPTA Newman

Myiolepta varipes Loew

GAINESVILLE (RCO) (OSU).

PARAGUS Latreille

Paragus bicolor Fabricius

GAINESVILLE 5-12-19 PWF (CLF) (EUM); 5-14-19 PWF (CLF) (EUM); 5-23-19 PWF (CLF) (EUM); 5-26-19 PWF (CLF) (EUM).

Paragus tibialis Fallén

ST. AUGUSTINE May 21 (CWJ) (Johnson 1913). PALATKA May 19 (CWJ) (Johnson 1913). HOMESTEAD 4-18-23 (AMNH).

PARHELOPHILUS Girschner

Parhelophilus divisus (Loew)

LAKE CITY 2-24-1892 (OSU). ORLANDO February 22 CR —listed

by Johnson (1913) as *Helophilus divisus* Loew. FLORIDA FlaFruitFlyTrapSurv. (CLF).

Parhelophilus laetus (Loew)

ALACHUA COUNTY 1938 (FMH).

Parhelophilus (Lejops) sp.

Close to *Lejops relictus* Curran and Fluke and related spp. DeLAND, Volusia County, 12-11-29 W.A.Hiers FlaFruitFlyTrapSurv. (CHC n.sp.). ORANGE COUNTY 2-1-30 J.E.Sadler FlaFruitFlyTrapSuvr. 2 spms. HIGHLANDS HAMMOCK STATE PARK 3-24-51 HVW,Jr. (CLF,-CHC) 2 spms.; 3-24-51 HVW,Jr. sweeping grasses (CLF); 3-27-51 HVW,Jr. sweeping shrubs (CHC); (CHC,CLF—both believe it to be n.sp.). OSCEOLA COUNTY 8-28-29 J.Kirkland FlaFruitFlyTrapSurv. 2 spms. FLORIDA FlaFruitFlyTrapSurv. 6 spms.

PIPIZA Fallén

Pipiza (Pipizella) australis Johnson

ST. AUGUSTINE 3-? Cotype (CLM coll.); 3-6-1897 CLM—labelled "Cotype" (AMNH); March 15 (Johnson 1913)—listed as *Pipiza pulchella* Will., a northern species, in his previous list. LAKE WORTH February Mrs. ATS—listed by Johnson (1913) as *Pipiza pulchella* Will. BISCAYNE BAY February Mrs.ATS—listed by Johnson (1913) as *Pipiza pulchella* Will.

Pipiza (Pipizella) banksi Curran

CLEWISTON 12-29-50 HVW,Jr. on *Bidens bipinnata* (CLF).

POLYBIOMYIA Shannon

Polybiomyia pedicellata (Williston)

ALACHUA COUNTY 4-13-38 (FMH)—as syn. *Cerioides pedicellata* Will.

PSILOTA Meigen

Psilota buccata Macquart

GAINESVILLE 2-23-19 PWF (CLF) 2 spms. (EUM); 2-23-19 PWF (CLF) 2 spms. (OSU); 2-24-19 PWF (CLF) (OSU). INVERNESS February 8-12-? CR (Johnson 1913).

Psilota flavidipennis Macquart

GAINESVILLE 2-24-19 PWF (CHC) (AMNH).

SPHAEROPHORIA St. Fargeau and Serville

Sphaerophoria cylindrica Say

CRESTVIEW 10-15-14 (AMNH). LONG KEY 4-19-23 (AMNH).

SPILOMYIA Meigen

Spilomyia hamifera Loew

Two spms.—GAINESVILLE 4-14-19 PWF (CLF) (EUM); GAINES-

VILLE 6-8-19 PWF (CLF) (EUM)—are labelled *Temnostoma excentricum* Harris, but I feel certain that these are *S.hamifera* Loew. ST. AUGUSTINE (CWJ) (Johnson 1913). ALACHUA COUNTY March 1938 (FMH). GAINESVILLE (RCO coll.) (OSU). INVERNESS March 6 CR (Johnson 1913). ORLANDO March 1944 R.&G.Bohard (USNM).

SYRITTA St. Fargeau and Serville

Syritta pipiens (Linnaeus)

FLORIDA (C.V.Riley coll.) (USNM).

SYRPHUS Fabricius

Syrphus knabi Shannon

DeFUNIAK SPRINGS 10-19-14 (CHC) 2 spms. (AMNH). ALACHUA COUNTY 10-10-40 (FMH).

TEMNOSTOMA St. Fargeau and Serville

Temnostoma pictulum Williston

ALACHUA COUNTY 4-16-41 H.Hixon (FMH). GAINESVILLE 3-28-19 PWF (FMH) (EUM); 5-8-36 (FMH). DADE COUNTY 8-9-33 (OSU).

Temnostoma trifasciata Robertson

GUNNTOWN, Levy County, 2 spms. (ANSP); March P.Laurent 2 spms. HIGHLANDS HAMMOCK STATE PARK 3-27-50 HVW,Jr. sweeping *Ilex glabra.*

TENTHREDOMYIA Shannon

Tenthredomyia abbreviata (Loew)

FLORIDA S.W.Williston—listed by Johnson (1913) as syn. *Cerioides abbreviata* Loew.

TEUCHOCNEMIS Osten-Sacken

Teuchocnemis bacuntius Walker

GUNNTOWN, Levy County, March P.Laurent (ANSP). ALACHUA COUNTY 3-10-23 (RCO) (OSU). GAINESVILLE 4-18-20 PWF (FMH) (EUM).

TROPIDIA Meigen

Tropidia albistylum Macquart

PENSACOLA October 1914 (AMNH). WHITE SPRINGS October 18 CHTT (USNM). ALACHUA COUNTY 11-1-37 H.Hixon (FMH). GAINESVILLE (RCO coll.) 4 spms. (OSU); 194? (RCO,FMH) 2 spms.; 2-23-19 PWF (CLF) 2 spms. (OSU); 2-23-19 PWF (CLF) 2 spms. (EUM); 2-24-19 PWF (CLF) (OSU); 5-18-19 PWF (CLF)

(EUM); 5-20-19 PWF (CLF) (EUM); 7-7-18 PWF (CLF) (EUM); 7-18-18 PWF (CLF) 3 spms. (EUM); 10-22-18 PWF (CLF) (EUM); 10-25-18 PWF (CLF) (EUM); (FMH) (M.T.James coll.). HIGHLANDS HAMMOCK STATE PARK 3-27-50 HVW,Jr. on *Ilex cassine*. SEBRING 3-16-51 HVW,Jr. on *Bidens bipinnata*. INVERNESS February 5 CR (Johnson 1913). CHARLOTTE HARBOR Mrs.ATS (Johnson 1913). LAKE WORTH Mrs.ATS (AMNH). MIAMI 1951 (CLF).

VOLUCELLA Geoffroy

Volucella abdominalis Wiedemann

CHOKOLOSKEE (Johnson 1913).

Volucella eugenia Williston

FLORIDA (Williston 1886)—Williston states, "It is nearest allied to *V.abdominalis* Wied., but will be distinguished by the lateral margins of the thoracic dorsum, and the scutellum, not being so distinctly yellow; it also lacks the large triangular yellow spot in front of the scutellum," FLORIDA S.W.Williston (Johnson 1913).

Volucella fasciata Macquart

GAINESVILLE (RCO coll.) (OSU); PWF (CLF) 3 spms. (AMNH); 11-2-18 PWF (CLF) (EUM); 2-23-19 PWF (CLF) 2 spms. (EUM); 5-26-19 PWF (CLF) 2 spms. (EUM); 5-10-21 PWF (CLF) (EUM); 10-27-47 HVW,Jr. on *Bidens bipinnata* (FMH); 11-7-47 HVW,Jr. on *Bidens bipinnata* (FMH); 12-3-47 HVW,Jr. on *Bidens bipinnata* (FMH) 12-8-47 HVW,Jr. on *Bidens bipinnata* (FMH); 2-18-48 HVW,-Jr. on *Prunus* sp. (FMH) 3 spms.; 5-20-50 HVW,Jr. on *Bidens bipinnata* 2 spms. CRESCENT CITY H.G.Hubbard 4 spms. (USNM); H.G.Hubbard *Opuntia tuna* 4 spms. (USNM). INVERNESS February 3 CR (Johnson 1913); March 24 CR (Johnson 1913). GOTHA W.M.-Wheeler (AMNH). COCOA July 1944 G.E.Bohart 3 spms. (USNM). LAKELAND March 29 W.T.Davis (Johnson 1913). SEBRING 3-20-50 HVW,Jr. on *Bidens bipinnata* 2 spms. LAKE WORTH (AMNH). MIAMI September 19 E.Mort. 2 spms. (USNM). FLORIDA (Coquillett coll.) 3 spms. (USNM).

Volucella nigra Greene

This species, which seems to range over all of Florida and into neighboring states, has been determined as *Volucella esuriens* Fabr., *Volucella mexicana* Macq., and *Volucella esuriens mexicana* (Macq.). Curran believes that there is only one species in Florida, and that it is *V.nigra* Greene.

ST. AUGUSTINE (CWJ) (Johnson 1913). GAINESVILLE 8-8-38 (USNM); 4 spms. (RCO coll.) (OSU); 10-26-18 PWF (CLF) (EUM); 11-5-47 HVW,Jr. on *Bidens bipinnata*; 11-7-47 HVW,Jr. on *Bidens bipinnata* 25 spms.; 12-3-47 HVW,Jr. on *Bidens bipinnata* 2 spms.; 12-8-47 HVW,Jr. on *Bidens bipinnata* (FMH)—det. as *V.esuriens* Fabr.; 12-9-47 HVW,Jr. on *Bidens bipinnata* (FMH) 2 spms.; 12-17-47 HVW,Jr. on *Bidens bipinnata* (FMH) 3 spms. GEORGIANA Wm.Wittfeld (USNM). ORLANDO 5-3-38 (H.Spencer coll.) Decayed papaya plant (CTG); 5-3-38 H.Spencer on decayed papaya plant 6 spms. (USNM);

6-15-27 F.W. (USNM); 6-22-27 MWolf 3 spms. (USNM); 5 spms. (USNM). LAKELAND 7-25-38 (USNM). KISSIMMEE April 27 to May 4 1936 (USNM). TAMPA 4 spms. (USNM). PASCO COUNTY 8-25-46 M.D.Neiswender 3 spms. (HVW,Jr.) (OSM); 8-29-46 M.D.Neiswender (HVW,Jr.) (OSM). LAKE WALES 9-12-47 HVW,Jr. Inside hot garage at dusk. I took only one specimen, but there were about two dozen buzzing around in the garage. VERO BEACH Benedict 4 spms. (AMNH). SEBRING 12-29-47 HVW,Jr. on *Tithonia diversifolia;* 2-21-48 HVW,Jr. on *Prunus myrtifolia* 4 spms.; 6-9-49 HVW,Jr. on *Bidens bipinnata;* 12-24-49 HVW,Jr. on *Helianthus* sp.; 3-20-50 HVW,Jr. on *Bidens bipinnata;* 12-23-50 HVW,Jr. on *Bidens bipinnata* 2 spms.; 12-25-50 HVW,Jr. on *Bidens bipinnata;* 12-25-50 Frank Mead on *Bidens bipinnata;* 3-15-51 HVW,Jr. on *Bidens bipinnata* 3 spms.; 3-19-51 HVW,Jr. on *Bidens bipinnata* 2 spms.; 3-20-51 HVW,Jr. on *Bidens bipinnata;* 3-20-51 HVW,Jr. on *Itea virginica* 4 spms.; 3-20-51 HVW,Jr. on *Itea virginica* (HVW,Jr.) (AMNH); 3-23-51 HVW,Jr. on *Ximeria americana;* 3-23-51 HVW,Jr. on *Litchi chinensis* 2 spms.; 3-25-51 HVW,-Jr. on *Ximenia americana* 3 spms.; 3-25-51 HVW,Jr. on *Ximenia americana* (HVW,Jr.) (AMNH); 3-26-51 HVW,Jr. on *Itea virginica* 2 spms. VENICE January-February 1934 B.R.Bales 3 spms. (OSM). CHARLOTTE HARBOR Mrs.ATS (Johnson 1913). LAKE WORTH Mrs.ATS 2 spms. (AMNH). FT. MYERS 1-10-33 W.M.B. (RCO coll.) (OSU). SANIBEL ISLAND (Johnson 1913). MARCO April 17 W.T.Davis (Johnson 1913). GLADELAND 5-19-28 H.R.Wolfe (USNM). CHOKOLOSKEE (USNM). MIAMI 6-1-17 T.E.Snyder Reared on *Carica papaya* Holotype, Allotype, 2 Paratypes No. 26200 (USNM); December 2 CHTT (USNM); November 30 Mrs.CHTT (USNM); December 1 Mrs.CHTT 3 spms. (USNM); E.W.Popenoe on Mango (USNM); July 2 CHTT (USNM); October 22 Mrs.CHTT (USNM); June 30 Mrs.-CHTT (USNM); November 3 Mrs.CHTT (USNM); February 10 2 spms. (ANSP); 9 spms. (AMNH); 2-7-19 PWF (CLF) (EUM). BISCAYNE BAY January Mrs.ATS (Johnson 1913); April Mrs.ATS (Johnson 1913). HOMESTEAD 2 spms. (AMNH); June 1949 D.O.Wolfenbarger Injuring Papaya or Avocado 2 spms. (USNM) I question this record; probably larvae were feeding in decaying fruit. HANLOVE (location unknown) March (USNM). CUTLER 5-5-08 (USNM). DADE CITY 5-12-39 D.J.&J.N.Knull (OSU). ROYAL PALM STATE PARK Lutz 2 spms. (AMNH). SOUTH FLORIDA March 1923 JSH (OSU). FLORIDA (Wm.H.Ashmead coll.) (ANSP); Maynard (USNM). KEY LARGO 1-3-51 HVW,Jr. on *Bidens bipinnata;* (AMNH). TORTUGAS ISLAND June 23 (RCO) (Johnson 1913). KEY WEST 2-8-1869 (C.V.-Riley coll.) (USNM). KEY VACA February 1939 B.R.Bales 3 spms. (OSM).

Volucella (Ornidia) obesa (Fabricius)

SEBRING 7-28-49 HVW,Jr. FT. MYERS 1-10-33 6 spms. (RCO coll.) (OSU); 1-10-33 (RCO coll.) (OSM). CHOKOLOSKEE (Johnson 1913). MIAMI 5-26-32 on *Quercus* sp. (FMH); 7-22-33 (CHC); 1-4-51 HVW,Jr. on *Bidens bipinnata.* MATHESON HAMMOCK 2-27-44 R.-Chermock (INHS); 3-5-44 R.Chermock (INHS). HOMESTEAD 3-22-

29 R.C.Bishop (USNM). PARADISE KEY, Dade County, 5-17-37 Richard Dow (USNM). FLORIDA (Osten-Sacken) (Williston 1886).

Volucella pallens Wiedemann

S.W.Williston listed species from Florida as syn. *V.sexpunctata* Loew. ST. AUGUSTINE March 15 (Johnson 1913). GAINESVILLE 5-14-19 PWF (HVW,Jr.); 5-9-21 PWF (HVW,Jr.) (EUM); 5-10-21 PWF (CLF) (OSU); 3-14-48 HVW,Jr. on *Citrus* sp. (FMH). INVERNESS February 12 CR (Johnson 1913). GEORGIANA (Johnson 1913). LAKE OKEECHOBEE May 2 W.T.Davis (Johnson 1913). CLEWISTON 12-29-50 HVW,Jr. on *Bidens bipinnata* 3 spms. CHARLOTTE HARBOR Mrs.ATS (Johnson 1913). SOUTH BAY May 2 W.T.Davis (Johnson 1913). LAKE WORTH Mrs.ATS (Johnson 1913) (USNM). MIAMI November 23 Mrs.CHTT (USNM). FLORIDA (ANSP); Willis (USNM); July 1882 Wm.Wittfeld 3 spms. (USNM).

Volucella pusilla Macquart

ST. AUGUSTINE 3 spms. (ANSP); March 15 (CWJ) (Johnson 1913); May 21 (CWJ) (Johnson 1913). NEWBERRY November 18 (Johnson 1913). CRESCENT CITY H.G.Hubbard on *Opuntia* 3 spms. (USNM). HIGHLANDS HAMMOCK STATE PARK 3-27-50 HVW,Jr. on *Ilex glabra*. SEBRING 2-21-48 HVW,Jr. on *Prunus myrtifolia* (FMH) 7 spms.; 7-28-49 HVW,Jr.; 12-23-50 HVW,Jr. on *Bidens bipinnata* 2 spms.; 3-16-51 HVW,Jr. on *Bidens bipinnata;* 3-19-51 HVW,Jr. on *Bidens bipinnata* (HVW,Jr.) (AMNH); 3-20-51 HVW,Jr. (HVW,Jr.) (AMNH); 3-20-51 HVW,Jr. on *Itea virginica*. OKEECHOBEE (AMNH). LAKE WORTH (RCO coll.) (OSU). FT.MYERS March 31 W.T.Davis (Johnson 1913). MIAMI (CHC coll.) (AMNH); October 30 CHTT (USNM); October 31 CHTT (USNM). BISCAYNE BAY Mrs.ATS 3 spms. (AMNH). KEY LARGO 1-3-51 HVW,Jr. TAVERNIER, Key Largo, 12-4-12 (USNM). KEY WEST 11-21-11 Geo.P.Engelhardt (USNM). FLORIDA (C.V.Riley coll.) 8 spms. (USNM); 3 spms. (USNM); Coquillett 2 spms. (USNM); July 1882 Wm.Wittfeld (USNM).

Volucella vesicularia Curran

Curran, 1947, writes that *V.vesiculosa* Fabr. is restricted to South America, and the North American species is therefore described as *V.vesicularia*. INVERNESS March 19 CR—listed by Johnson (1913) as *V.vesiculosa* Fabr. LONGWOOD 4-1-30 D.J.Nicholson (USNM).

XYLOTA Meigen

Curran and Fluke recognize *Heliophilus* Meigen (1803); Hull recognizes *Xylota* Meigen (1822); European workers recognize *zelima* Meigen (1800).

Xylota analis Williston

ST.AUGUSTINE CWJ (CWJ) (AMNH). CHARLOTTE HARBOR March Mrs.ATS (CWJ) (AMNH).

Xylota bicolor Loew

ALACHUA COUNTY 4-16-38 (FMH); 4-15-22 (RCO) (OSU). GAINESVILLE 19? (FMH).

Xylota ejuncida Say

The type, a male, came from Florida. A specimen from Cherry Harbor det. CWJ 1913 as *Xylota analis* Will., was later determined by CHC as *Xylota viridaenea* Shannon; in 1941 Curran made *X.viridaenea* Shannon a syn. of *X.ejuncida* Say. ALACHUA COUNTY 5-9-35 (FMH). GAINESVILLE (RCO) (OSU). CHARLOTTE HARBOR—labelled *Heliophilus ejuncida* (Say) (AMNH).

Xylota (Xylotomima) metallica Wiedemann

JACKSONVILLE Mrs.ATS (USNM). ALACHUA COUNTY 5-25-38 H.Hixon (FMH). HIGHLANDS HAMMOCK STATE PARK 3-27-50 HVW,Jr.

Xylota pigra (Fabricius)

WHITE SPRINGS October 16 Mrs.CHTT (USNM). JACKSONVILLE 3 spms. (USNM). GAINESVILLE 194? (FMH); 2-23-19 PWF (CLF) 2 spms. (EUM). INVERNESS February 8 CR (Johnson 1913); March 25 CR (Johnson 1913). FLORIDA Mrs.ATS (Johnson 1913).

Xylota quadrimaculata Loew

HIGHLANDS HAMMOCK STATE PARK 3-27-50 HVW,Jr. on *Ilex cassine*.

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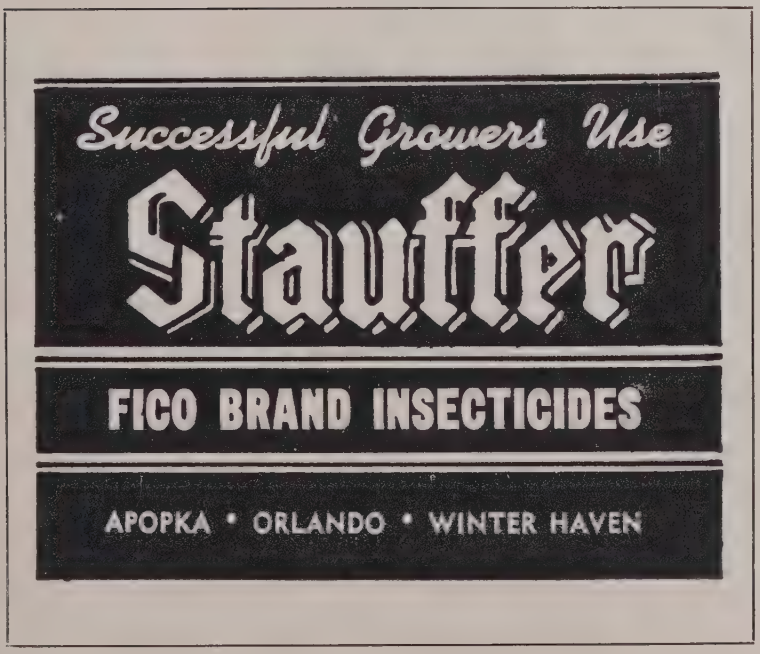

A COMPARISON OF THE COST OF SPRAYING CITRUS TREES UTILIZING TWO DIFFERENT SPRAY MACHINES *

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The spraying of citrus groves is a costly operation. Many years of research have been spent in attempting to devise less costly spray programs, both by altering the use of the various materials and by changing to different kinds of equipment. In 1948 the author (1) discussed the entire cost of production problem in 33 groves which were directly under his supervision. In that study total costs varied between 29 cents and 43 cents per box. Of this charge, the spray program consumed between 8.1¢ and 11.4¢ per box. Approximately half of this cost was for material and half for labor and operational cost of equipment.

During most of the 1948 operation complete cost figures were kept for two spray machines. One was a Model JXD Speed Sprayer with a 500 gallon tank. The second machine was a standard hand sprayer with a 600 gallon tank.

The Speed Sprayer operation involved the use of two 500 gallon truck supply units and a tractor to pull the sprayer. The three drivers in this operation received 80 cents per hour. The hand machine was mounted on a truck. The driver received 80 cents and the two spray hands 70 cents per hour.

An accurate check of the gasoline and oil consumption of all of these pieces of equipment was kept in addition to an account of all repairs. By using the standard cost accounting procedures of the employing firm, depreciation figures on the equipment were also available.

Table 1 presents a summary of data obtained in this study. Several factors are outstanding. The Speed Sprayer applied the spray at a slightly lower cost per gallon in the over-all operation; however, it was considerably cheaper when only the cost of labor, gas, and oil were considered. It was the depreciation and repairs on the several pieces of expensive equipment which ran up the costs of the Speed Sprayer operation.

This study points up one of the major advantages of using a mechanical sprayer like the Speed Sprayer. It was able to apply two and one-half times as many gallons per hour as the hand machine. Thus, one Speed Sprayer could do as much work

*Presented at the 1948 Annual Meeting of the Fla. Entomological Society.

TABLE 1.—COMPARATIVE SPRAY COSTS BETWEEN A SPEED SPRAYER AND A PRESSURE MACHINE IN APPROXIMATELY A ONE YEAR OPERATION

	Speed Sprayer	Pressure Sprayer
Tanks	2821	1072
Hours of operation	894	1031
Gallons per hours	1577	624
Total labor cost	$2097.75	$2283.54
Labor cost per gallon	.00148	.00355
Total cost of gasoline and oil	$1248.24	$ 365.12
Cost per gallon	.00088	.00056
Cost of labor, gas and oil per tank	$ 1.19	$ 2.47
Cost per gallon of spray	.00235	.00411
Cost of repair and depreciation per gallon	$ .00240	$ .00136
Total cost per gallon	$ .00475	$ .00547

as two and one-half hand machines when three men were employed in both operations. It would do this at a slightly lower cost, but the biggest advantage would be a saving in time. This allows greater elasticity in planning spray operations and permits the owner to time sprays properly. Also it will tend to prevent the situation where large acreages need spraying and there is insufficient time to do the job.

SUMMARY AND CONCLUSIONS

The costs of running a Speed Sprayer were compared with those of a standard orchard hand spray machine for one year's operations in citrus groves in Florida. The Speed Sprayer applied two and one-half times as many gallons as the hand rig at a cost of .475 cents per gallon. The cost per gallon for the hand machine was .547 cents.

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NOTES ON NORTH AMERICAN SPECIES OF PTEROBOSCA

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In the December number of the Florida Entomologist (33: 141-144, 1950) mention is made of two defective specimens of *Pterobosca* from Puerto Rico that were not described. Recently I was fortunate enough to find in the Cornell University collection two more specimens in good condition of the same species and from the same locality. The species, named *P. incubans* by Macfie, was originally recorded from British Honduras. It is a small form chiefly black in color, the feet without claws, the fourth tarsal segment somewhat shorter than the fifth, and with but a single spermatheca.

To Macfie's description (Proc. R. Ent. Soc. London, 6: 111, 1937) may be added:

The eyes are sparsely and short haired; the palpi are a scant 0.1 mm. in length, the last three segments having lengths in proportion to each other of 7 - 5 - 6, the third segment swollen and with a large sense pit, last segment slender and tapering, terminating in a few long hairs. The antenna is 0.3 mm. in length, the ratio of the length of segments 10 to 15 combined to length of segments 3 to 9 combined is about 2.4; the latter segments disc-like, transverse. Wing length 0.7 to 0.9 mm., width 0.3 to 0.35 mm. Hind basitarsus averages 3.5 times longer than the second segment. The empodium is large, three-fourths as long as the fifth segment, complex, with 10 or 11 rays, resembling that of *P. aeschnosuga*, as figured by Macfie (Tijdschr. v. Ent. 75:268. 1932). Length of insect 1.4 mm.

Macfie's statement that the eyes are bare is incorrect. Specimens in the U. S. National Museum that were collected in Mexico and determined by Macfie as *P. incubans* have pilose eyes, the pile visible under a magnification of 400 to 500 diameters, especially distinct when the specimen is first treated with caustic potash.

The type described by Macfie was found on the wing of *Argia ulmeca*. Specimens examined by me were collected by Dr. J. G. Needham at L. Tortuguero, Puerto Rico, on February 10 and March 21, 1935, and from Leres, P. R., in March, 1935. the hosts are *Erythrodiplax umbrata* and *Lepthemia vesiculata*. For the privilege of examining the Mexican specimens mentioned above, I am indebted to Dr. W. W. Wirth of the U. S. National Museum.

Pterobosca fusicornis (Coquillett)

Ceratopogon fusicornis Coq. Jour. N. Y. Ent. Soc. 13: 63, 1905.
Pterobosca macfiei Costa-Lima. Inst. Oswaldo Cruz. Memorias. 32: 616, 1937.
Pterobosca floridana Joh. Fla. Ent. 33: 143, 1950.

Dr. W. W. Wirth of the U. S. National Museum called my attention to the fact that the species described by Coquillett under the name of *Ceratopogon fusicornis* is a *Pterobosca* and pointed out that *P. floridana* Joh. and probably also *P. macfiei* Costa-Lima are synonymous with *fusicornis*. It appears that the degree of variation in the antennal and tarsal ratios among individual specimens is too great to warrant the use of these ratios as diagnostic specific characters.

Since the publication of the account of this species in the December number of this journal I have found on the wings of dragonflies in the Cornell University collection three more specimens in better condition which enable me to add the following data:

The antennal ratio is 3.1, the same as for the specimen described in the above mentioned article. Both the thorax and the abdomen are sparsely beset with black bristles of varying lengths. The spermathecae, short oval in form, are two in number. The basistyle of the hind leg is about three times as long as the second tarsal segment. The dragonflies upon which these specimens were found were collected by Dr. J. G. Needham.

Royal Palm State Park, Florida. March 16, 1939. On *Pachydiplax longipennis*.
Lake Placid, Florida. April 12, 1940. On *Cryphaeschna ingens*.
L. Tortuguero, Puerto Rico, March 21, 1935. On *Erythrodiplax umbrata*.

Pterobosca sp.

A Puerto Rican species taken from the wing of *Lepthemia vesiculosa* resembles the African *P. mollipes* Macfie in size, in lacking claws, in having two spermathecae, and in having a sense pit on the third palpal segment, but differs in antennal and palpal proportions, and somewhat in wing venation. The specimen is broken and lacks most of its legs but the attention of collectors is called to it because of its habitat. It may prove to be but a variant of *P. mollipes*. The most striking differences are the relative lengths of the last three palpal segments (7 - 6 - 9.2), the greater antennal ratio (2.5), and in the wing venation, the anterior branch of the media ending *before* the wing tip.

The dragonfly host was collected by Dr. J. G. Needham at L. Tortuguero, Puerto Rico, March 21, 1935.

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BOOK NOTICES

A FIELD GUIDE TO THE BUTTERFLIES OF NORTH AMERICA, EAST OF THE GREAT PLAINS, by Alexander B. Klots. xvi + 349 pages, 8 figures, 40 plates. 1951. Houghton Mifflin Company, Boston. Price $3.75.

This most recent addition to Houghton Mifflin's Field Guide Series is the outgrowth of many years of study of the Lepidoptera by Dr. Klots. The author has applied the Field Guide system to his treatment, bring the butterfly taxonomy up to date, and includes much information on distribution and life-histories. Of the species treated, 247 are illustrated by color paintings and 232 are shown in black-and-white photographs. There are sections on collecting and preserving specimens, the butterfly and its environment, life histories and growth, classification, and identification. Three appendices include some principles of classification, butterfly literature and collections, and a checklist of butterflies and skippers. The book admirably accomplishes its purpose of putting pertinent information into a form that will be most useful to the novice as well as to the more advanced student. Dr. Klots' book is well written and beautifully illustrated.—L. B.

A SELECTED BIBLIOGRAPHY OF THE INSECTS OF THE WORLD ASSOCIATED WITH SUGAR CANE, THEIR PREDATORS AND PARASITES, by J. S. Wade. 113 pages. 1951. International Society of Sugar Cane Technologists, Honolulu. Memoir No. 1.

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